PROJECT NUMBER: 2106
PROJECT TITLE: Cigarette Performance and Design
PROJECT LEADER: R. W. Dwyer
PERIOD COVERED: November 1988

I. FILTER RESEARCH AND DEVELOPMENT (J. Kao)

A. **Objective**: Evaluate the influence of tobacco-rod butt length on filter efficiencies.

B. **Results**: A mathematical model has been developed which accounts for the effect of tobacco-rod butt length on filter efficiency. Eastman has provided us with the raw data required to develop such a model. Their data include TPM deliveries as functions of puff volume and puff position for cigarettes with a variety of filters. These data, as well as in-house results, have been used to model the effects of filter pressure drop, dimensions, tow item, ventilation level, and puff position on efficiencies.

C. **Conclusions**: As the butt length decreases, the smoke removal efficiency of the filter increases, most likely due to increased condensation of vapors on the filter. The increase in efficiency is a function of of the reciprocal of the rod butt length.

D. **Plans**: This model will be incorporated into the expert-system based cigarette design model.

II. CIGARETTE DESIGN COMPUTER MODEL (D. Leister and L. Watt)

A. **Objective**: Provide the Filter R&D Project with an expert-system based cigarette-design system.

B. **Results**: The hardware and software to run the cigarette-design-and-performance system have been installed in the Filter R&D lab at the O.C. Instructions for using this prototype system were provided as well as a demonstration run.

C. **Plans**: This system will be refined on a continuing basis by incorporating our on-going research results, and also by enhancing its ease of use. At this time we are adding the capability of selecting tow items for concentric filters and predicting their effects on cigarette deliveries.

III. FILTER VENTILATION (D. Simpson)

A. **Objective**: Predict filter ventilation levels based on the permeabilities of tipping papers and plug wraps.

B. **Results**: We have had cigarettes fabricated with a variety of tipping papers and plug wraps, all other design parameters being held constant. These models were made with zero, one, or two anchor lines on the plug wrap. Additionally, experiments have

been performed in which the pressure drops as functions of flow rate were measured for radial flow through CA filters.

C. **Conclusions**: The presence of anchor lines has little effect on the level of filter ventilation. The contribution of radial flow through the filter plug directly under the vents is relatively small, but needs to be accounted for in predicting filter ventilations.

D. **Plans**: These results will be incorporated into a mathematical model for predicting ventilation levels. Further experiments are in progress for evaluating the influence of different tipping machines on filter ventilation levels.

IV. TPM GENERATION EFFICIENCIES (L. Goodwin and B. Dwyer)

A. **Objective**: Evaluate the effects of blend composition on the generation of TPM.

B. **Results**: We have developed equations which allow the calculation of the weight of tobacco consumed during a single puff. We have also developed equations for estimating the weight of TPM generated at the coal during a single puff. Using these relationships, the cigarette data in the CI data base have been evaluated for TPM generation efficiencies, i.e., the ratio of generated-TPM-weight to consumed-tobacco-weight.

C. **Conclusions**: The TPM generation efficiencies of cigarettes vary from brand to brand over a relatively small range. Currently we are examining the data base to see if correlations exist between the generation efficiencies and the blend compositions of the CI brands.